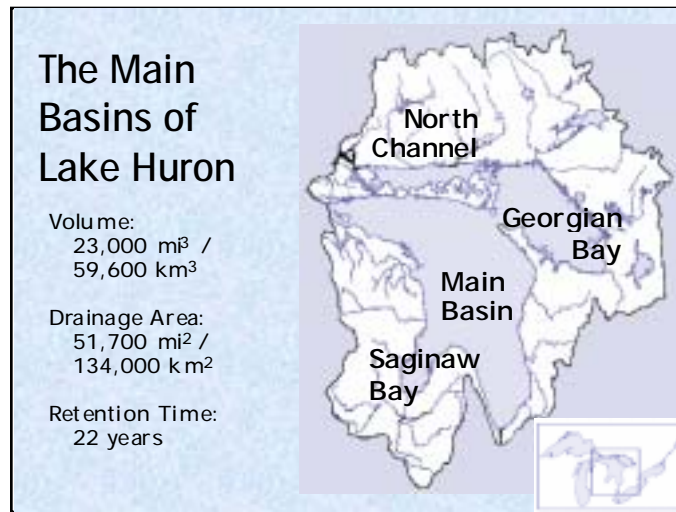




- Good morning. My name is Jim Bredin and I'm with the Michigan Office of the Great Lakes.
- On behalf of the US EPA's Great Lakes National Program Office, Environment Canada, and the State of Michigan, I will be providing our overview of the ecological integrity of Lake Huron.



- Lake Huron is the third largest Great Lake by volume, but its watershed has the largest drainage area of all the Great Lakes.
- Within this vast watershed are four fairly distinct sub-basins, especially with respect to geology, shoreline processes and land use. They are: Saginaw Bay in the U.S., the binational Main Basin, and Canada's Georgian Bay and North Channel.



- There is a rich diversity of ecosystems within the watershed, including the sandy south western shores of Lake Huron in Michigan.



A Diversity of Ecosystems



- ...And of course the well-known islands and rocky shores of Canada's Georgian Bay.



- Within the watershed there are also five Areas of Concern: the St. Marys River, Spanish River, Saginaw River and Saginaw Bay, Severn Sound, and the St. Clair River.
- The Lake Huron Areas of Concern have strong programs which are advancing clean-up. Many of the sources of pollution within these Areas of Concern are being addressed.
- In fact, Canada has recognized Spanish Harbour as an Area of Recovery where all remedial actions have been implemented, and is in the process of delisting Severn Sound as an Area of Concern.



Status of Lake Huron

- Historical sources of pollution, but relatively low pollution levels.
- Abundance of shoreline habitat, but increasing development pressure and hardening of shoreline.
- High diversity of aquatic and riparian species, yet continuing threat and spread of invasive species.
- Overall Status: Mixed



•While the ecosystem is quite complex, several basin-wide assessments can be made:

•The more densely populated areas of the basin have been historical sources of pollution, but overall, Lake Huron has relatively low pollution levels compared with more heavily urbanized Great Lakes.

•The Lake's shoreline is largely undisturbed, but more recent conversion of land for cottages and more intensive use is putting increasing pressure on the system.

•The Lake's relatively undisturbed shoreline and nearshore areas still support a high diversity of aquatic and riparian species, yet invasive species continue to pose a threat to these populations.

•The health of fish communities is of particular concern in



Impacts to Lake Huron Ecosystem Integrity

- Chemical:
 - Fish Consumption Advisories
 - Wildlife Health
- Biological:
 - Impaired Benthic Communities
 - Fish Community Alteration
- Physical:
 - Habitat Restoration/Protection

The Lake Huron ecosystem integrity is driven by three principle issues:

- Fish Consumption Advisories and Wildlife Health
- Impaired Benthic Communities
- Fish Community Alteration and
- Habitat Restoration and Protection

These issues encompass the chemical, physical, and biological concerns in the lake basin.



Chemical Integrity

- Fish Consumption Advisories
- Wildlife Contaminants



•As I just mentioned, fish consumption advisories and contaminants in wildlife are the major issues that drive the chemical concerns for Lake Huron. These issues are in turn driven by sources such as historical sediment contamination, air deposition, and non-point source pollution.

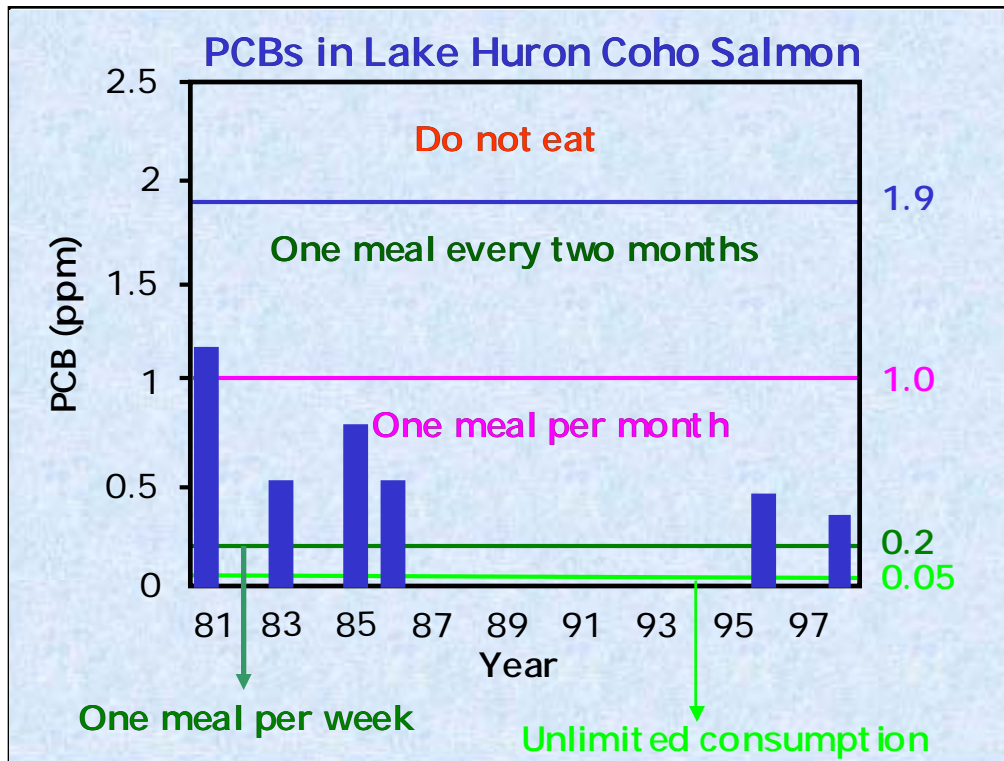


Chemical Integrity

- Main SOLEC Indicators
 - Contaminants in Edible Fish Tissue
 - Contaminants in Young-of-the-Year Spottail Shiners
 - Contaminants in Colonial Nesting Waterbirds
 - Atmospheric Deposition of Toxic Chemicals
 - Toxic Chemical Concentrations in Offshore Waters
 - Phosphorus Concentrations and Loadings

•The Lake Huron Initiative developed a suite of indicators for Lake Huron. Of this suite, there are two indicators for which we have data and are tracking pollutant trends. These are **Contaminants in Edible Fish Tissue** and **Contaminants in Colonial Nesting Waterbirds**.

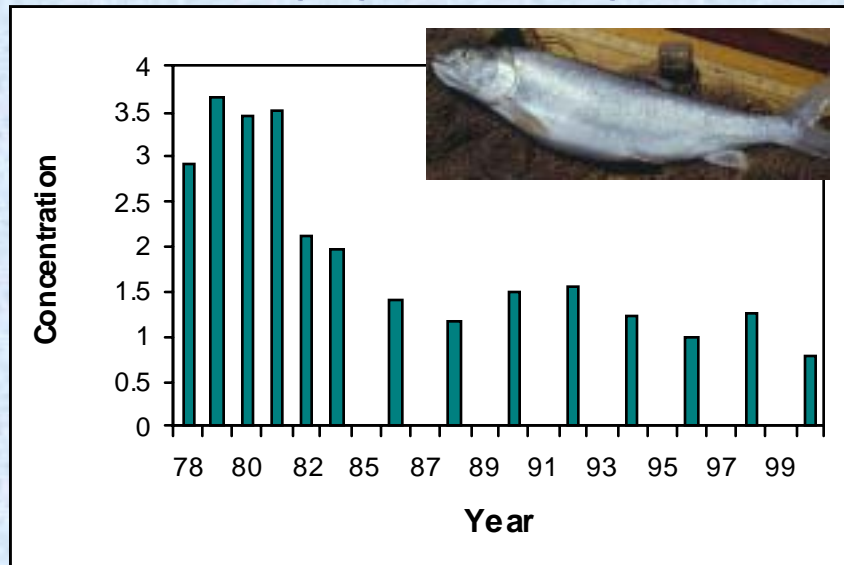
•I will also present some initial data on phosphorus concentrations in the basin.



Regarding contaminants in edible fish tissue, the U.S. EPA-Great Lakes National Program Office monitors the level of contaminants in salmon. As shown on this slide the level of contaminants in coho and Chinook salmon are on a downward trend.



PCBs in Huron Lake Trout (ug/g wet weight)

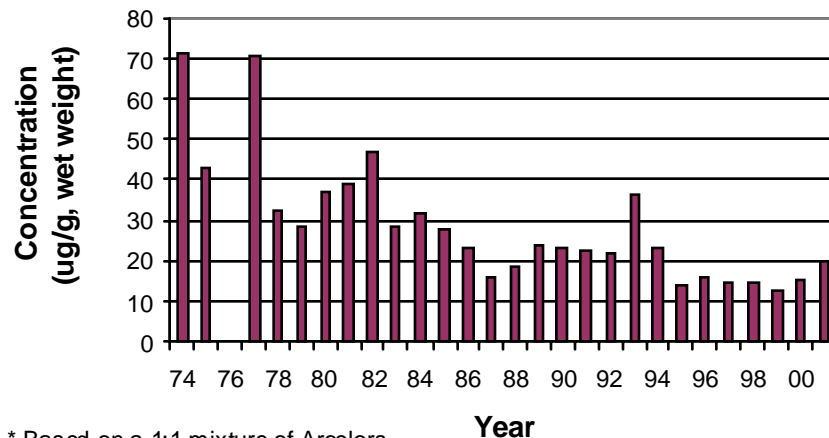


- The EPA-Great Lakes National Program Office lake trout monitoring program is not a direct correlation with edible fish tissue because it analyzes the contaminant load in the whole fish.
- However, it is a good indicator of the trend in contaminate loading from an ecosystem perspective.
- The recent trend indicates decreased concentrations in lake trout.



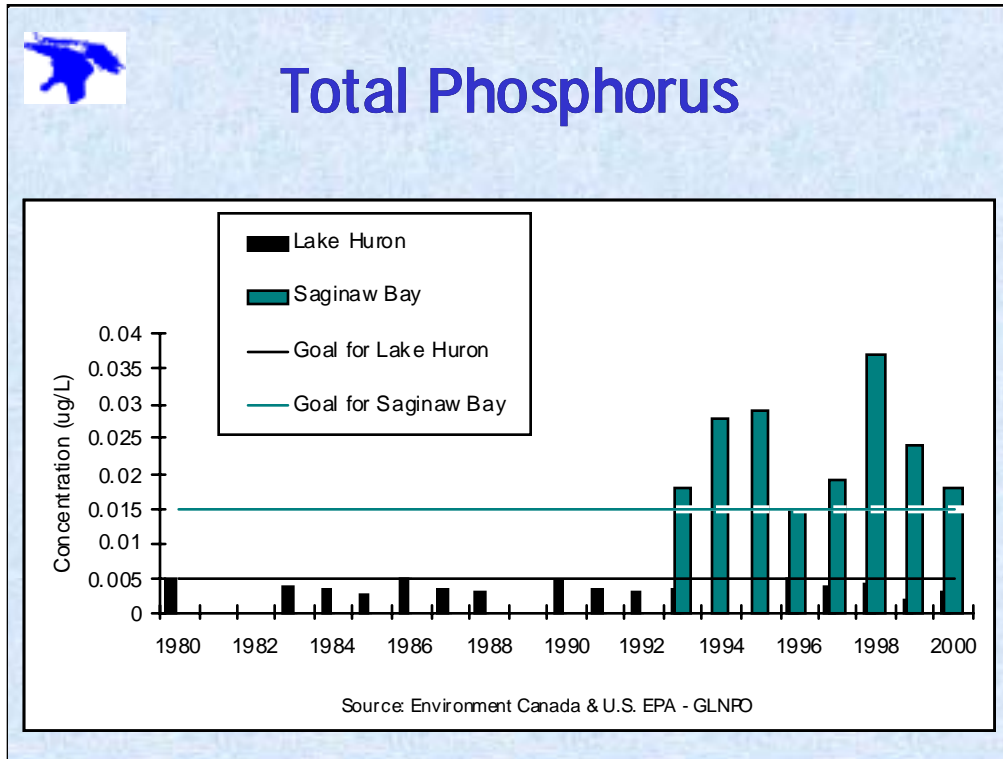
Lake Huron Total PCBs* in Herring Gull Eggs

(1974-79 values based on two sites, Chantry and Double Islands;
1980-present values include Saginaw Bay site as well.)



* Based on a 1:1 mixture of Aroclors
1254:1260

- As I mentioned, wildlife health is an important issue in Lake Huron.
- The herring gull eggs indicator is of particular importance to determine wildlife contaminant trends.
- Herring gull eggs have been shown to be improving in Lake Huron, but there are hot spots in the basin where concentrations are still relatively high.



- Total phosphorus is not only an important indicator of chemical integrity but it also predicts eutrophication effects and impacts on local biota.
- Phosphorus levels have been meeting the goals for the main basin of Lake Huron.
- However, concentrations are of concern in areas such as Saginaw Bay, Georgian Bay, and the North Channel.



Biological Ecosystem Integrity

- Changes in Lower Food Web
- Fish Community Alteration

•Lake Huron is undergoing rapid change in biodiversity and ecosystem function. Some of the changes are short term, while others are more persistent. The complete nature and rate of changes in the ecosystem are hard to document, since Huron is one of the lesser-studied lakes.

•However, two major issues have been identified: Changes in the lower food web and Fish community alteration.



Biological Integrity – Lower Food Web

- Main SOLEC Indicators
 - Benthos Diversity and Abundance
 - Diporeia (as part of Lake Trout and Scud indicator)
 - Preyfish Population
 - Zooplankton
 - E. coli and Fecal Coliform Levels in Nearshore Recreational Waters

•As part of the Lake Huron Initiative, a number of indicators have been identified that are important to track trends associated with the lower food web and fish community, as shown.

•As part of the on-going effort in Lake Huron we are tracking these indicators where data is available.

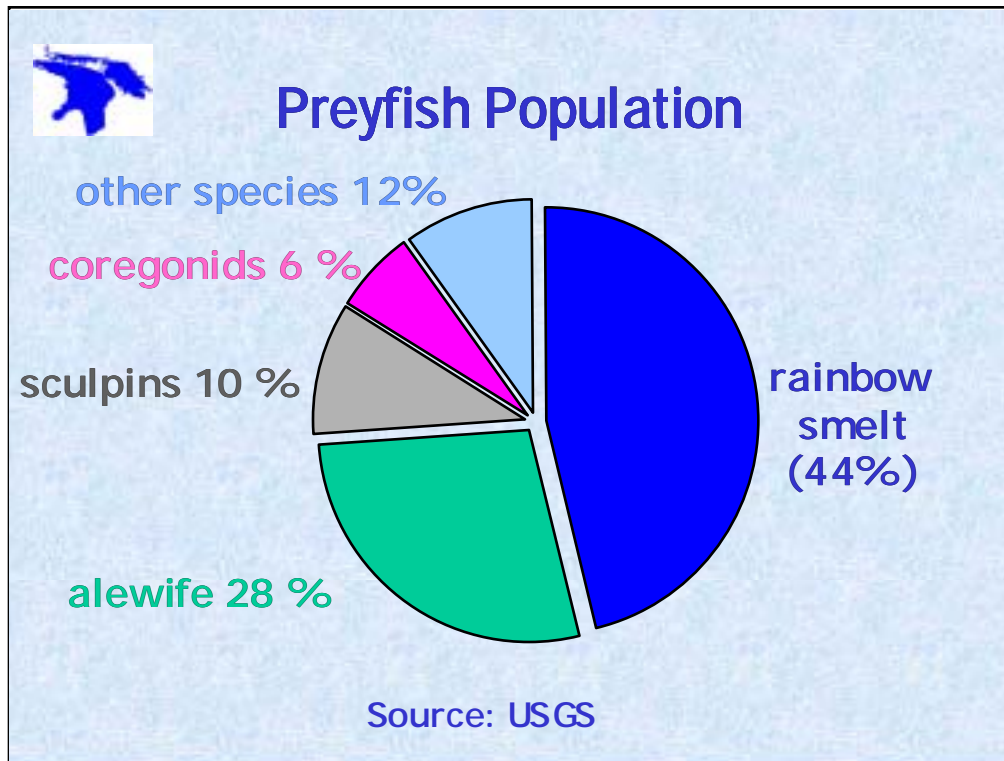
•Today I will be providing data on the Preyfish Population, Zooplankton and E. coli and Fecal Coliform Levels in nearshore recreational waters.



Benthic Communities

- Invasion of zebra mussel and other species
- Studies to investigate changes in benthic species and biomass, especially *Diporeia*
- Fish communities respond by altering food sources or face declining populations

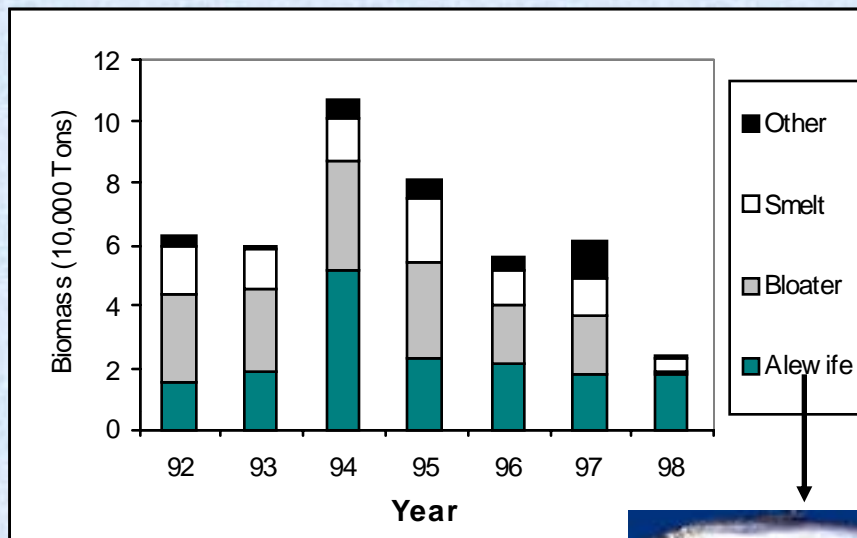
- In the early 1990s, there was wide recognition that considerable ecosystem changes were occurring due to invasions of the zebra mussel and other non-natives.
- Similar to what has been occurring in Lake Michigan and Lake Ontario, Lake Huron is losing important fish food animals, most notably *Diporeia*.
- As a result potential loss of prey species requires fish communities to respond by seeking other food sources or face declining populations.



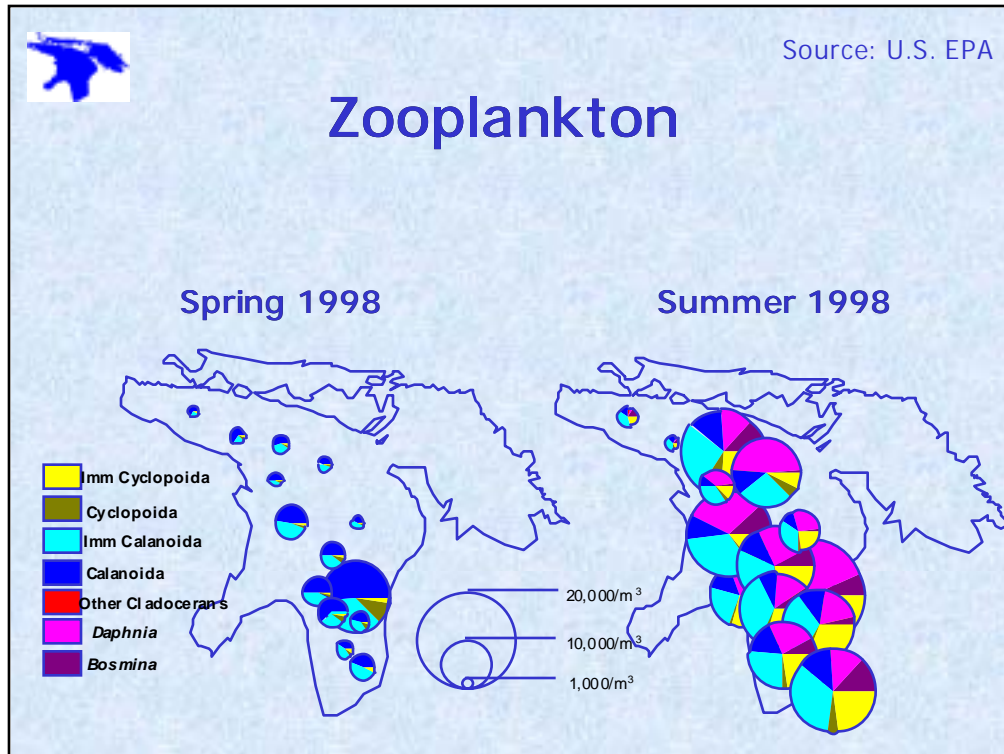
- This slide provides a look at the preyfish population in Lake Huron based on abundance. As you can see, rainbow smelt and alewives, both non-native species, provide over 70 percent of the preyfish population.



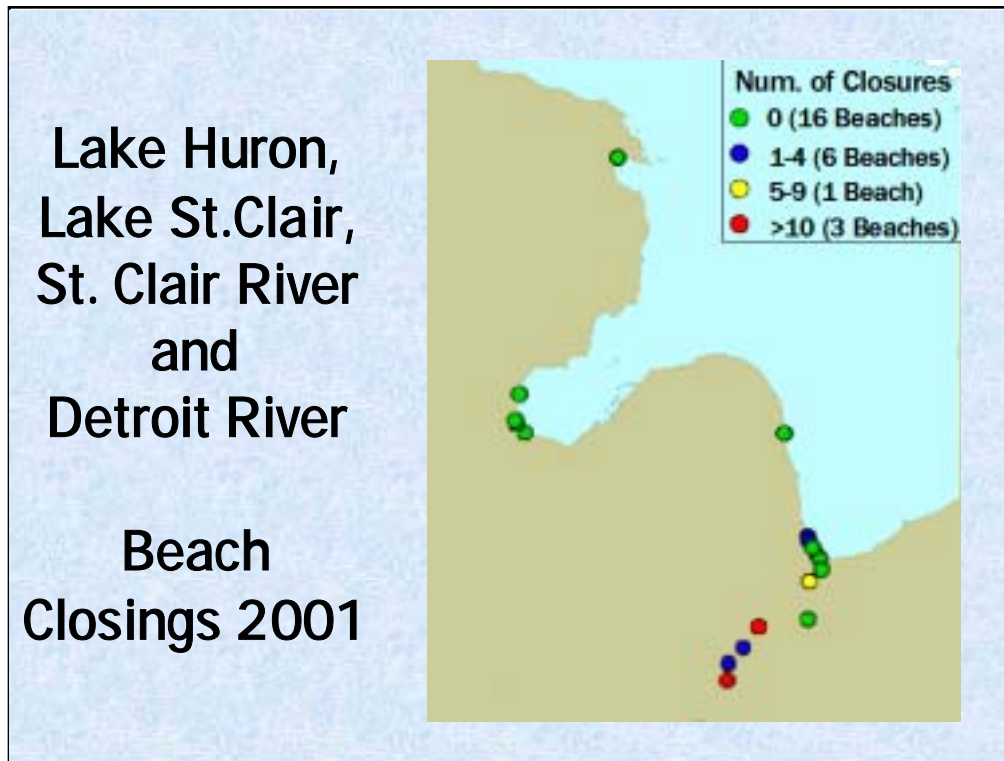
Biomass of Major Prey Fishes



- However, from a biomass perspective, smelt, bloaters and alewives provide the majority of the biomass with recent trends, indicating that alewives are becoming more important as the prey fish biomass decreases.



- Zooplankton populations also play an important role in the ecosystem integrity of the basin.
- We are initiating work to track zooplankton populations and develop an indicator to help determine future trends.



- As we work to develop a basinwide indicator for beach closings due to **E. coli and Fecal Coliform levels**, several data sets are helping inform us of the status of Lake Huron Beaches.

- Shown here is a summary of beach closing on the U.S. side of Lake Huron.

- While beach closings are known to vary from year to year, initial information suggest that a small subset of Lake Huron beaches are of concern.



Biological Integrity - Fish Community Indicators

Main SOLEC Indicators:

- Walleye and Hexagenia
- Exotic Species
- Fish Habitat
- Sea Lamprey
- Salmon and Trout

•Several indicators are required to produce a measure of how fish communities are coping with changes in the ecosystem.

•As part of the Lake Huron Initiative, shown here are a number of indicators that are important to track these trends.

•Dave Ried will be providing a more detailed discussion of the Lake Huron fishery, however I would like to present some basic information on this subject.



Fish Community Alteration

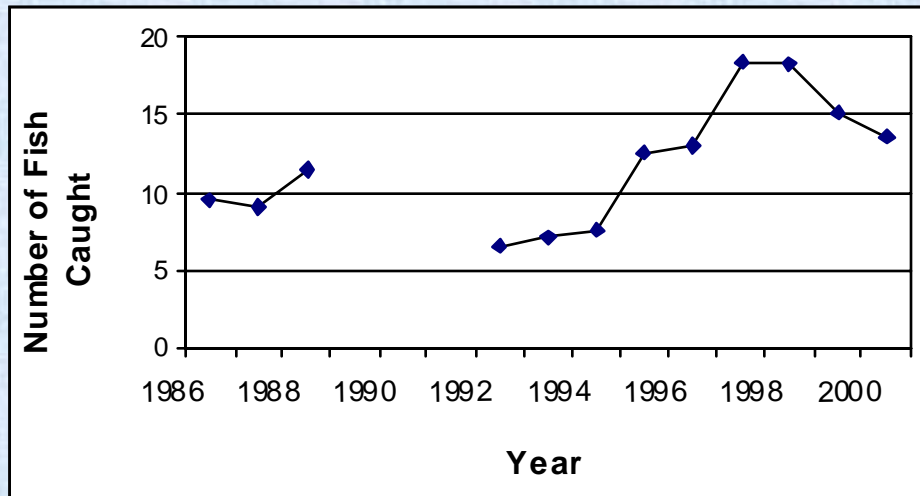
- Improvements in fishery over last several decades
- Decreased contaminant levels
- Good habitat, some tributaries are stressed



- Overall, the impact of fish community alteration in Lake Huron is not as severe as in other systems in the Great Lakes. The health of the fish community in Lake Huron has improved since the 1960s, when fish health was at its poorest.
- Levels of some contaminants, namely DDT and PCBs, have declined, improving fish vitality.
- Habitat in the main basin of Lake Huron itself is in relatively good health, however many of the tributaries in the system are still severely stressed.

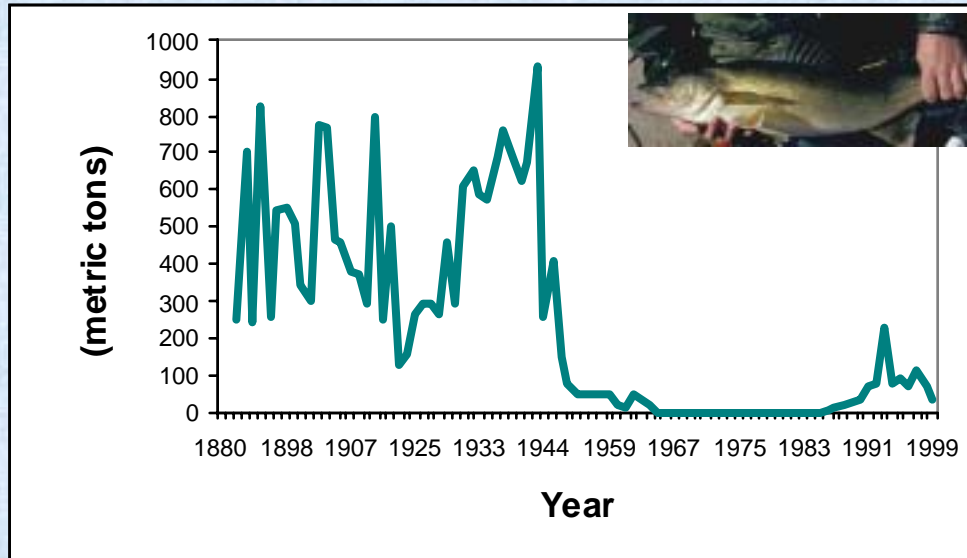


Number of Trout and Salmon Caught per 100 hours of Angler Effort

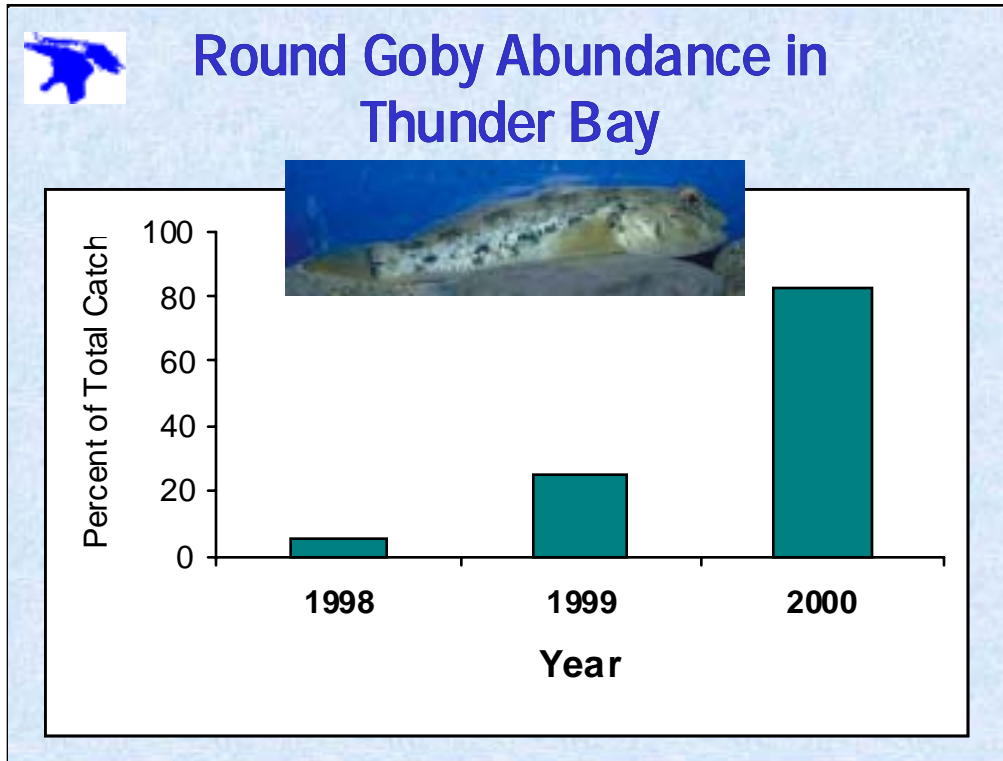


- However, with relatively high trout and salmon catch rates and a declining prey population, the sustainability of the current fisheries is questionable.
- Dave will be telling us more about how the combined impact of the ecosystem pressures on Lake Huron fish communities pose a significant effect to the biological integrity of the system.

Walleye Yield (Catch) thought to be attributable to Natural Reproduction



- There are some encouraging signs. This slide shows that there was once a relatively robust natural reproduction of walleye in Saginaw Bay. From the late 1960s to the early 1980 there was little to no natural reproduction. In the last few years, natural reproduction has once again been documented.



- Unfortunately, non-native species are another persistent and significant factor influencing fish community alteration.
- This slide shows that the population of Round Goby found in Thunder Bay, Michigan continues to expand.



Though much of the Lake Huron shoreline is undisturbed, physical disturbances are taking place.

- Resource extraction, water level variation and localized urban activities, are leading to permanent habitat loss.
- Also, changes due to water level fluctuation patterns are altering the littoral zone habitat.

Of greatest concern is the effect of structural barriers between stream reaches that reduce connectivity and block important fish habitat.

Also, fragmentation of coastal wetlands is another important issue. Connectivity of wetland habitat is as important to ecosystem health as total wetland area. Scattering of wetlands compromises the utility and value of the habitat. The integrity of the habitat is fundamental to maintaining healthy communities. If habitat is in good condition, many communities maintain healthy function.



Physical Integrity

- Main SOLEC Indicators:
 - **Habitat fragmentation**
 - Sediment flowing into coastal wetlands
 - Coastal wetland area by type
 - Extent of hardened shoreline
 - Protected nearshore areas

As part of the Lake Huron Initiative, a number of indicators were identified that are important to track trends associated with physical integrity of the basin.

In the time that I have left, I want to provide some basic information on habitat fragmentation. Dave Ried will be expanding upon this topic in the next presentation, but I would like to lay some of the foundation for this discussion here.



Habitat Fragmentation

- Dams impound highest-gradient rapids and block migrations of Lake Huron fishes
 - Species affected include trout, salmon, lake sturgeon, whitefish, walleye
- Dams disrupt sediment transport needed to maintain delta wetlands at river mouths
 - Species affected include yellow perch, northern pike, muskellunge

- Fish habitat fragmentation is a significant issue in the Lake Huron basin.
- Dams and spillways fragment stream systems, which prevent fish from accessing upstream spawning habitat.
- In addition, the lack of sediment transport downstream can impact the quality of habitat at the river mouths.

For lake sturgeon, walleye, Chinook salmon and other river spawning fish, stream fragmentation reduces natural reproduction and increases dependence on fish stocking.



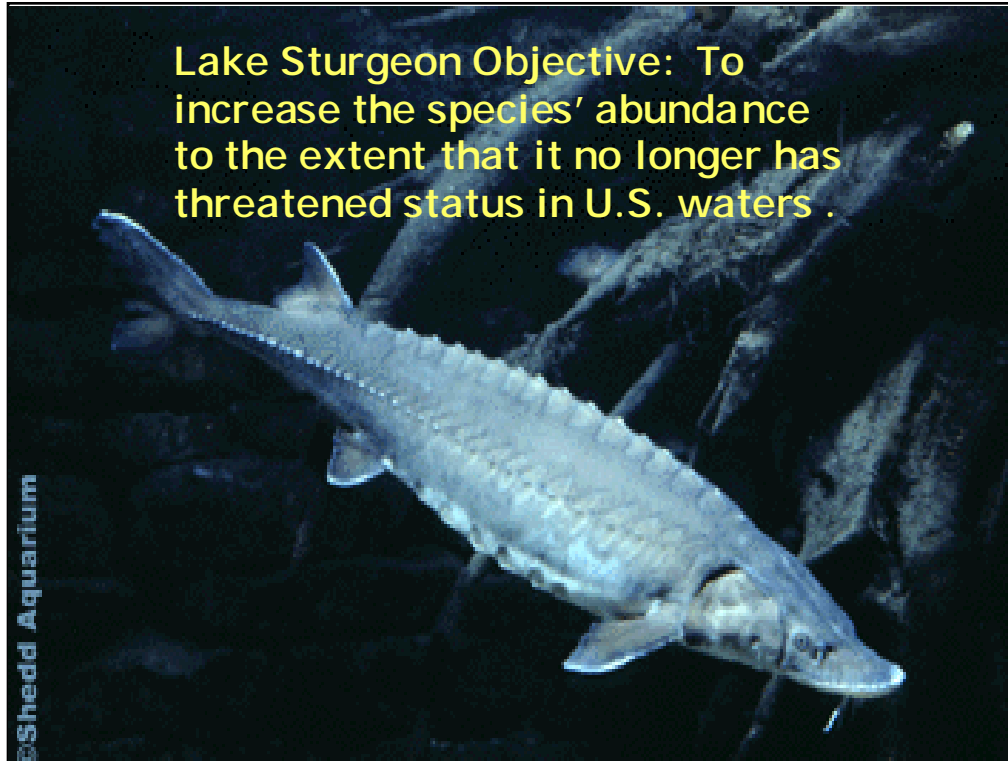
Habitat Fragmentation

- Inundate rare, high quality habitats
- Disrupt woody debris transport
- Increase summer temperatures and prevent night-time cooling
- Reduce aquatic insect diversity and density
- Also prevents non-native species, including lamprey from reaching upstream areas



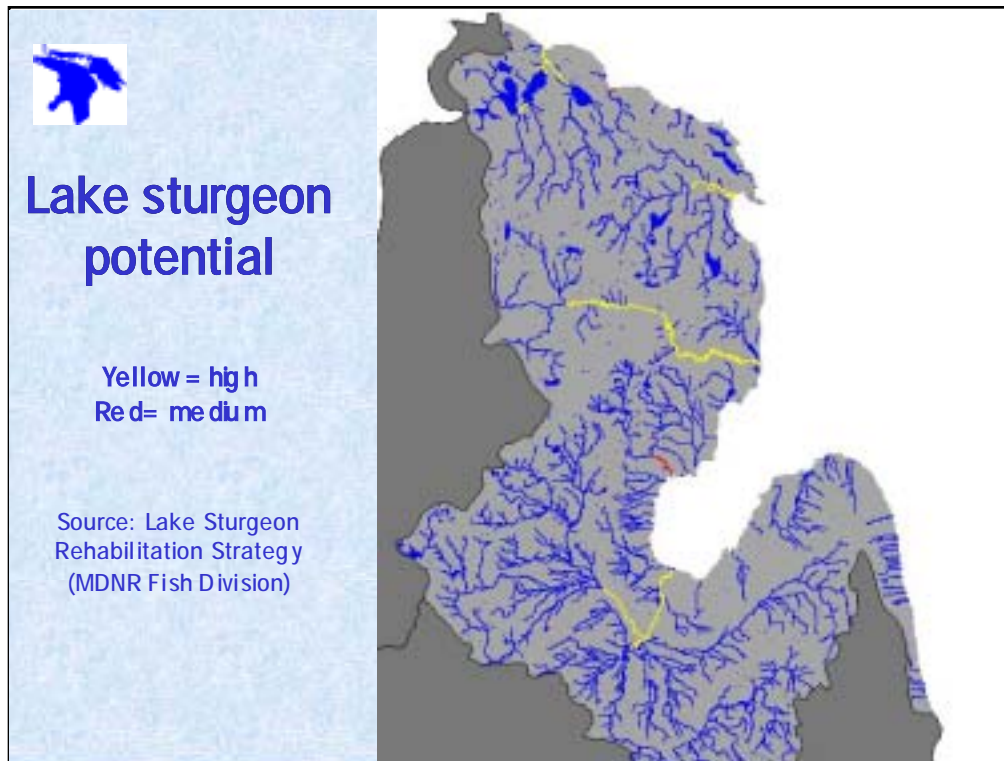
Dams also:

- inundate rare, high quality habitats,
 - disrupt the transport of woody debris to downstream areas,
 - increase summer water temperatures and prevent night-time cooling,
 - and reduce aquatic insect diversity and densities.
- Of course it is also important to remember that dams prevent the expansion of invasive species into unaffected areas – a fact that must also must be considered.

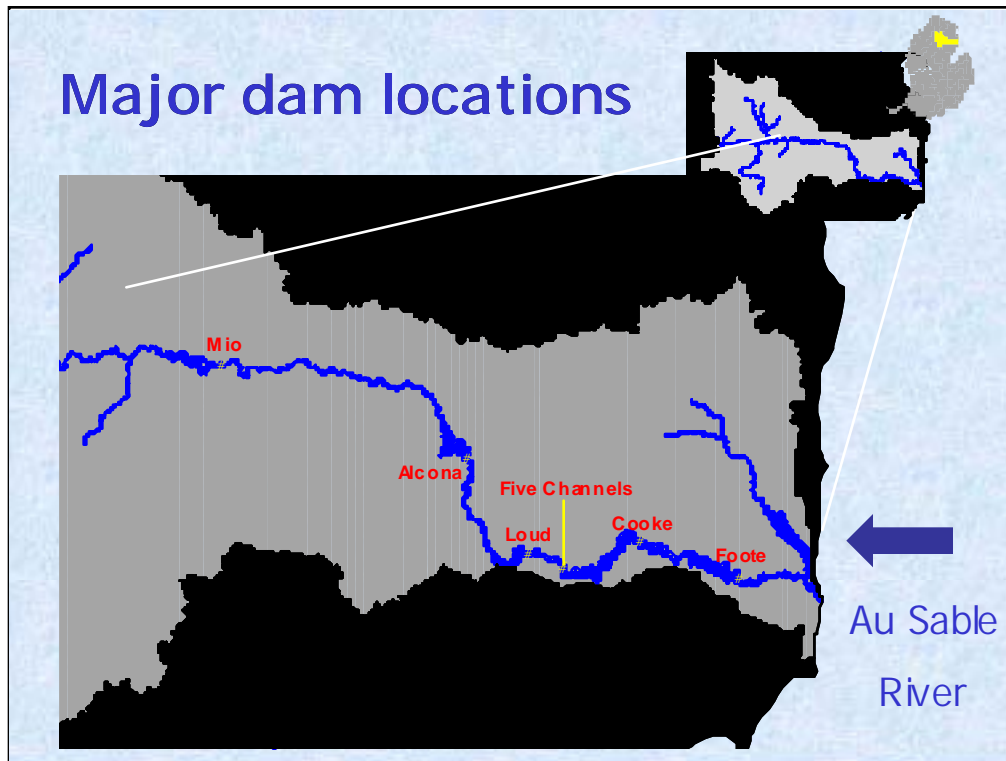


- As an example of the impact of dams on the Lake Huron Fishery, consider Lake Sturgeon.
- The Lake Huron Committee's Lake Sturgeon Objective is "To increase the species' abundance to the extent that it no longer has threatened status in U.S. waters."
- Lake Sturgeon require high gradient waters for spawning.
- Many of these areas are currently under impounded water.

-Sturgeon and walleye migrated up to the mouth of the North Branch, about 115 miles upstream from Lake Huron



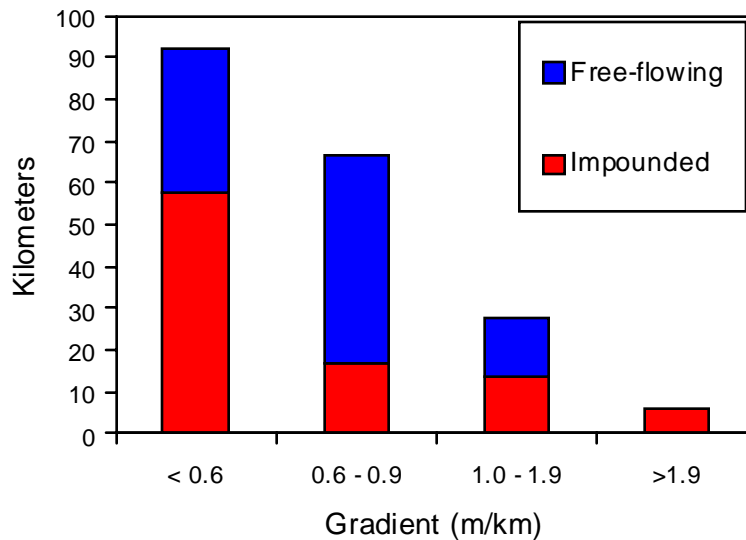
By using the new Lake Huron GIS system, the Michigan Department of Natural Resources, with data from their Lake Sturgeon Rehabilitation Strategy and their Valley Segment Database, has identified the potential for Lake Huron tributaries to have habitat suitable for spawning. The yellow tributaries have high potential and the red tributaries have medium potential for effective restoration.



- Based on the Michigan DNR's Au Sable River Assessment, the Au Sable River in northeast Michigan has six major dams, many of which are impounding water over high quality areas.

Au Sable River Gradient Distribution

from South Branch Au Sable River to river mouth



Looking at those areas that have dams, and using the Lake Huron GIS system, researchers have determined that a majority of the high gradient habitat, greater than 1.0 meters per kilometer, is currently impounded. The two categories on the right provide excellent spawning habitat for sturgeon, but much of this areas is unavailable to Lake Huron sturgeon due to dams.



Biological potential of Lake Huron Streams

- Biological potential of existing high-gradient habitats between Mio and Foote dams: 14,440 Adult lake sturgeon.
- *The Lake Huron watershed has a great, untapped biological potential.*

Michigan DNR researchers have determined the biological potential of existing high-gradient habitats between the six dams on the Au Sable to be almost 15 thousand new adult lake sturgeon.

Without giving too much away, I think Dave will show us that the tributaries of Lake Huron hold a great, untapped biological potential.



Actions Needed to Restore Ecosystem Integrity

- Complete on-going sediment cleanups (Saginaw River/Pine River)
- Provide support to AOCs
- Monitor atmospheric inputs
- Lakewide monitoring coordination
- Minimizing the impact of non-native species

To wrap up this presentation I need to point out that there are a number of very important actions necessary to restore and maintain the ecological integrity of the Lake Huron basin. These actions include:

- Completion the on-going sediment cleanup in the Pine River.
- Provide support to the Areas of Concern to assist in efforts to delist these sites.
- Monitoring of atmospheric inputs to determine the pollutants delivered through the air.
- Development of a lakewide effort to coordinate on-going monitoring which will in turn lead to a better understanding and more effective management of the Lake Huron ecosystem. and
- Controlling invasive species introduced into al the Great Lakes including efforts to better understand and minimize the impact of these species.



Additional Actions Needed...

- Provide fish passage to high quality areas
- Develop alternatives to activities that harden the shoreline
- Identify important coastal wetland areas
- Control nonpoint source of pollution
- Improve coordination between Great Lakes agencies and community partnerships

Also, it's important to understand that many of the issues related to habitat fragmentation are political, financial and jurisdictional issues as opposed to science issues. Physical barriers to fish migration can be removed or fish passages can be constructed to reduce the impact of stream on river fragmentation. Since removal activities are costly, removal of fish migration barriers is a slow process. Over the long term, programs that assist dam owners to dismantle aging or obsolete dams would be beneficial.

In addition, assistance is needed to help landowners find alternatives to activities that harden the Lake Huron shoreline. We need to identify ecologically important coastal areas. We need to control nonpoint source to minimize sediment and other pollutant delivery to our tributaries. And we need to improve coordination between Great Lakes agencies and community partnerships to more effectively use our scarce resources.



On-going Lake Huron Efforts

- Lake Huron GIS System development.
- Working closely with the GLFC Lake Huron Committee on Environmental Objectives development.
- Combining effort towards implementation of the Lake Huron Binational Partnership.



In closing I'd like to point out that there are a couple of very important on-going activities regarding Lake Huron. The first is the continued development of the Lake Huron GIS System. As you saw in the presentation the Lake Huron GIS system is becoming functional and being used to make resources management decision. This new tool will help drive science-based decision in the basin.

Secondly, the environmental community is beginning to work closely with the Great Lakes Fishery Commission's Lake Huron Technical Committee in the development of environmental objectives relating to fisheries management. This relationship will benefit environmental and fisheries managers by providing increased coordination of on-going efforts.

And lastly, the two federal governments, with Michigan and Ontario as partners, are combining efforts toward development and implementation of what we are calling the



Lake Huron Binational Partnership

For additional
information contact:

Jim Bredin,
Michigan Office
of the Great Lakes

James Schardt, USEPA
Great Lakes National Program Office

Janette Anderson, Environment Canada



I'd like to thank you for allowing me to provide this update on Lake Huron and if you would like additional information regarding the development of the Lake Huron Binational Partnership contact either:

- myself
- James Schardt, US EPA Great Lakes National Program Office or
- Janette Anderson of Environment Canada

Thank you.

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